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University Campus LEED Building Energy Consumption Analysis: A Case Study in Predicted Versus Actual Energy Consumption



Fig. 1: Biorenewables Research Laboratory

Problem Statement:

ISU Facilities, Planning, and Management (FP&M) is concerned with new LEED buildings on campus consuming more energy than originally predicted.

Current assumptions used in the creation of these LEED energy models need to be re-evaluated.

Objectives:

1. Determine if the Biorenewables Research Laboratory (BRL) on campus is consuming more energy than the model predicted.
2. Analyze the historic energy consumption of the building against the modeled consumption.
3. Develop recommendations to improve the accuracy of future building energy models on campus.

Methods:

- Determine the energy consumption from the energy model and compare against historical energy consumption obtained from ISU FP&M.
- Trend the energy model weather data (TMY2 DSM) against historical weather data.
- Weather normalize the model energy consumption to historical average based on degree days.

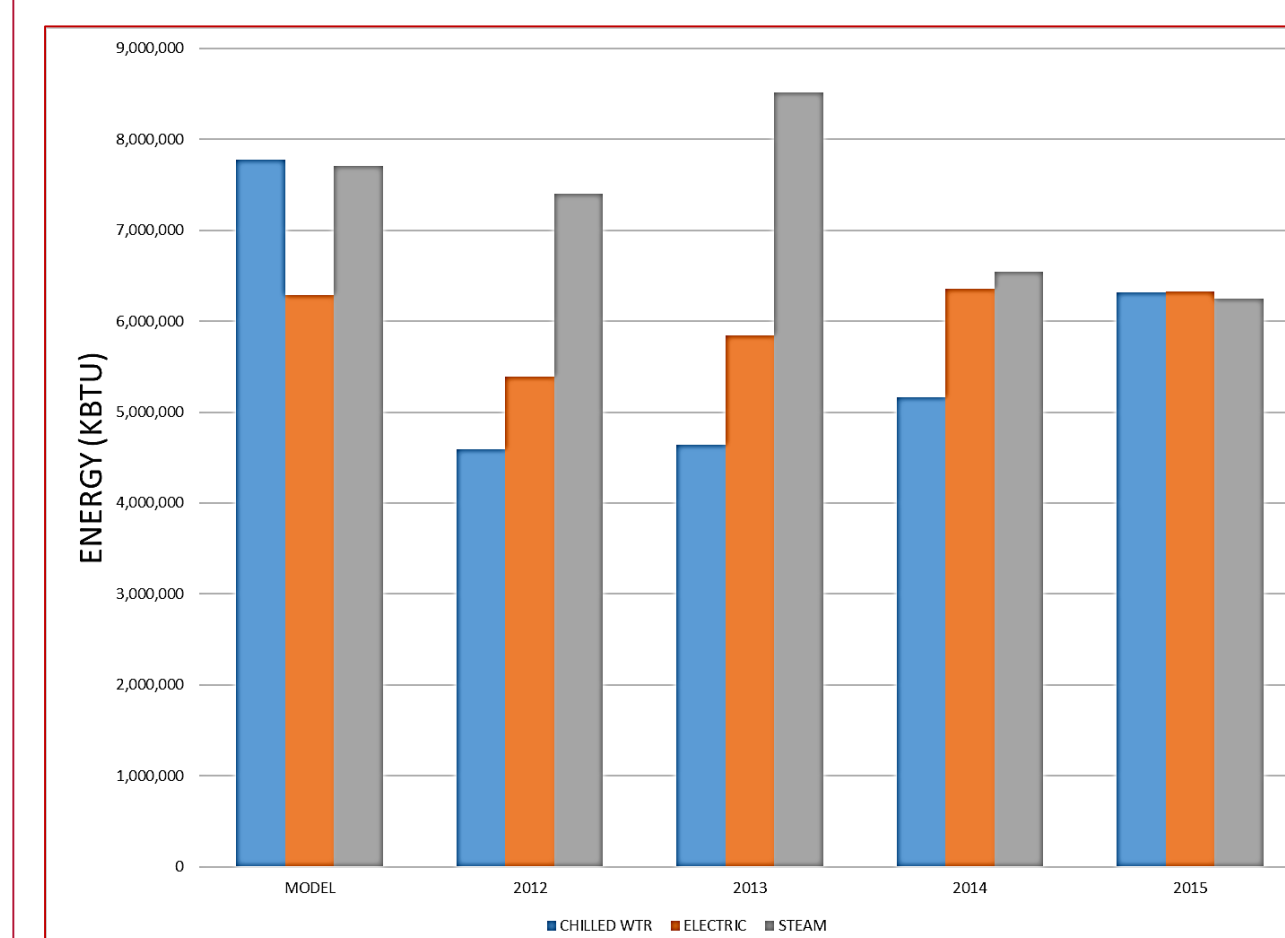


Fig. 3: Yearly Energy Usage

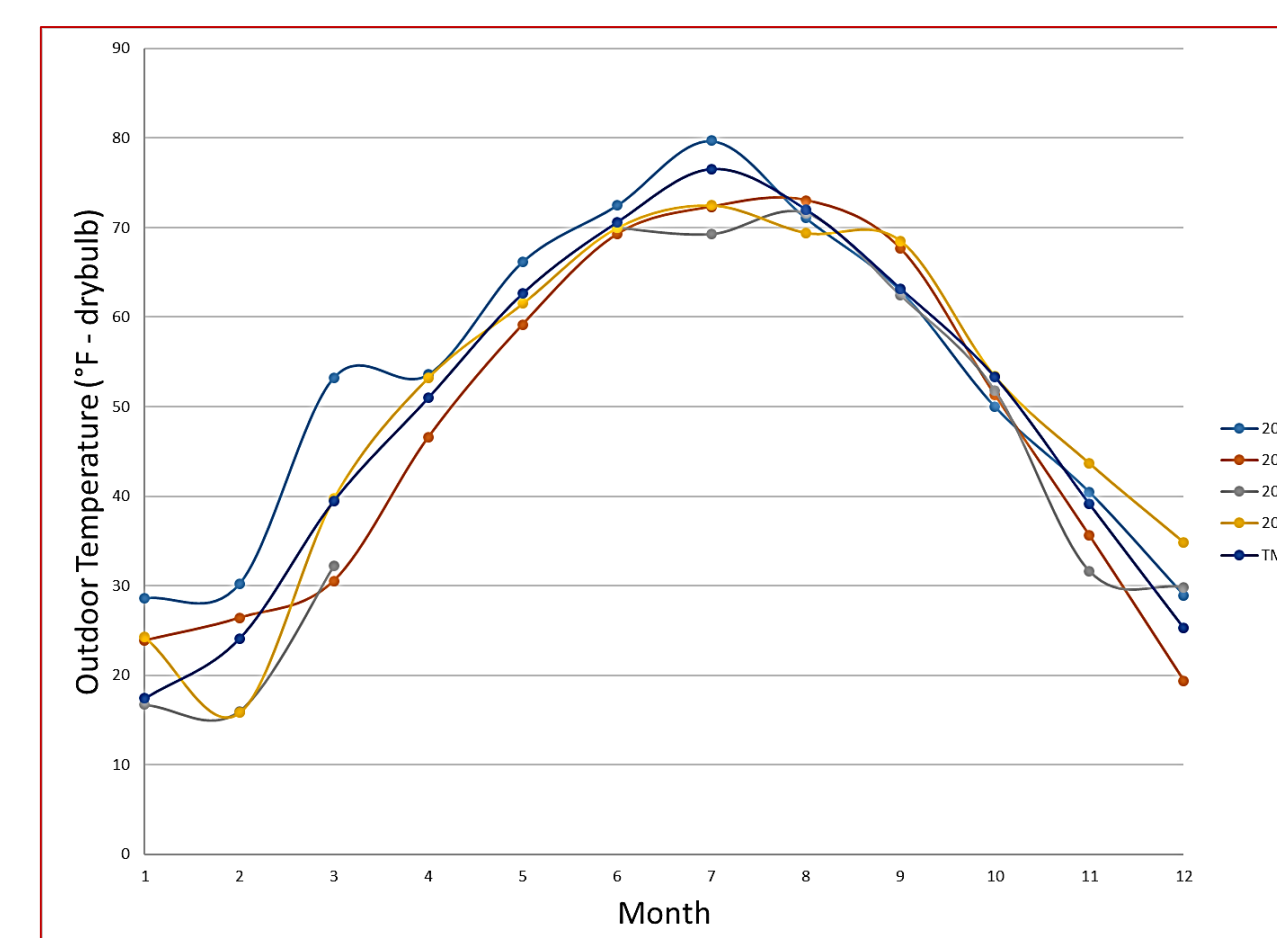


Fig. 4: Average Monthly Temperatures

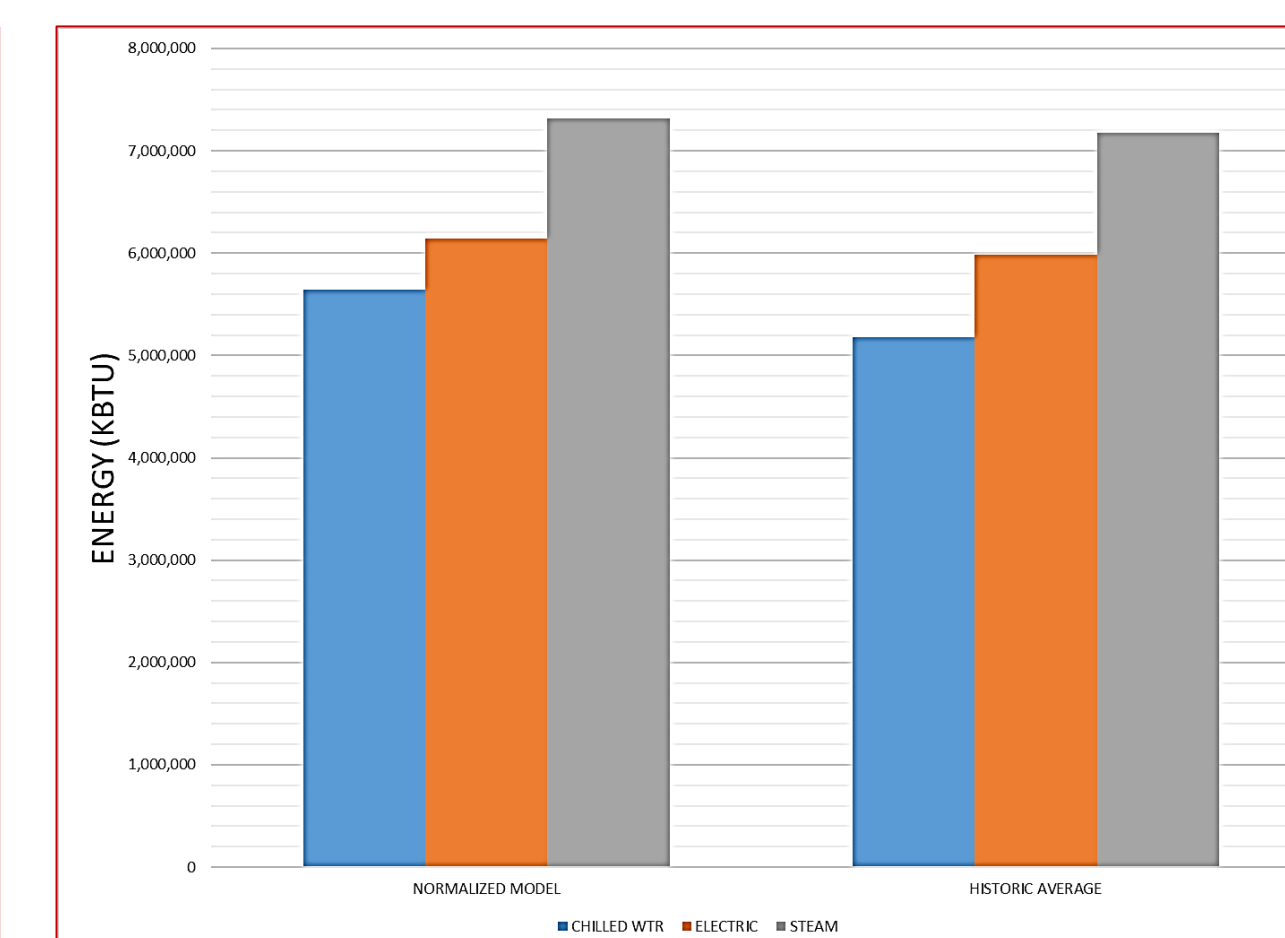


Fig. 5: Normalized Energy Usage

Results:

- The BRL building is consuming 4% LESS energy than the model originally predicted overall.
- The BRL building is spending 25% MORE on utility bills than the model originally predicted.
- Utility rates have been much higher in recent historic years in comparison to the utility rate that was used to calculate yearly utility costs in the energy model.
- Building energy consumption within each specific system is changing over time.

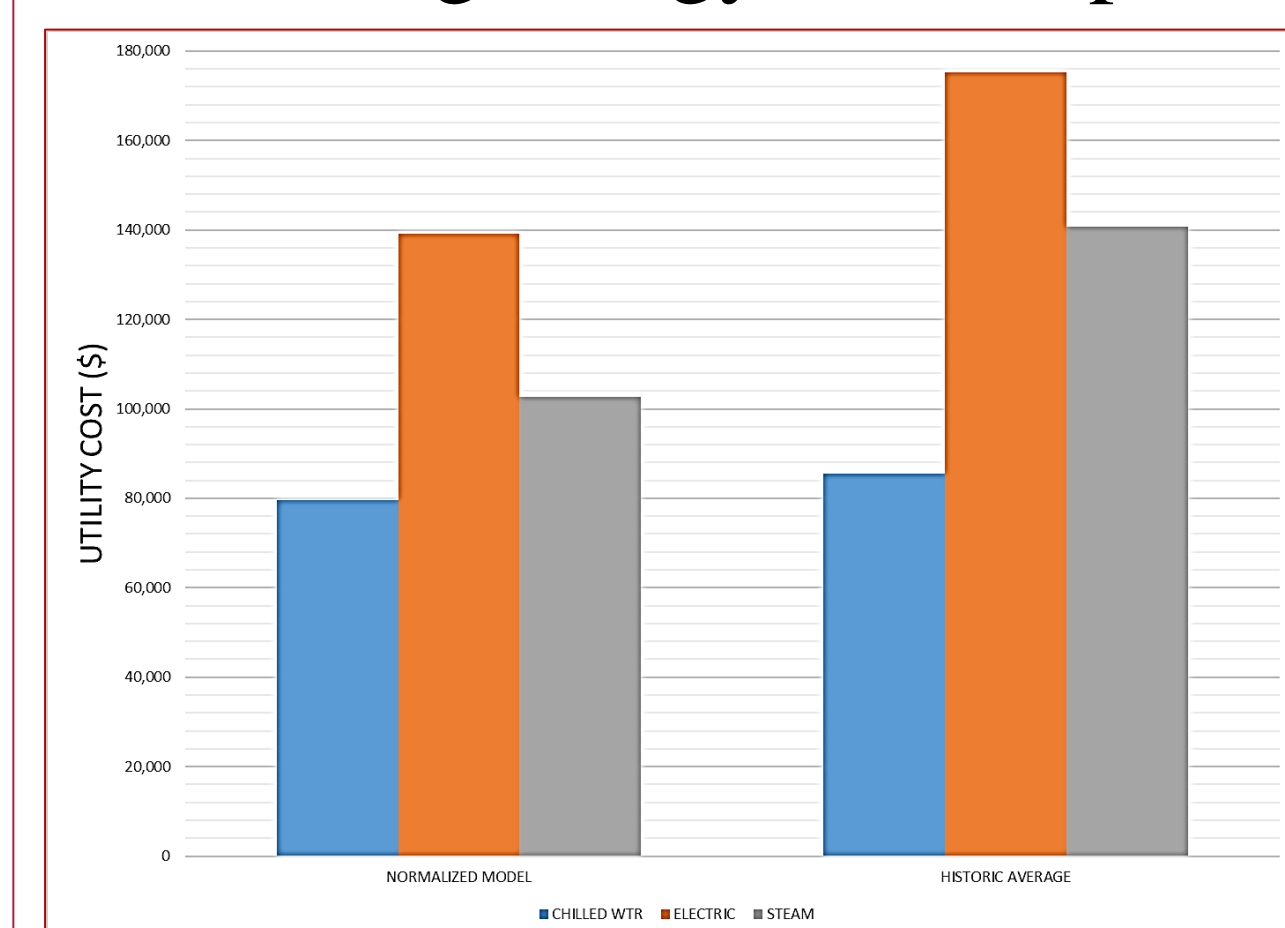


Fig. 6: Yearly Utility Costs

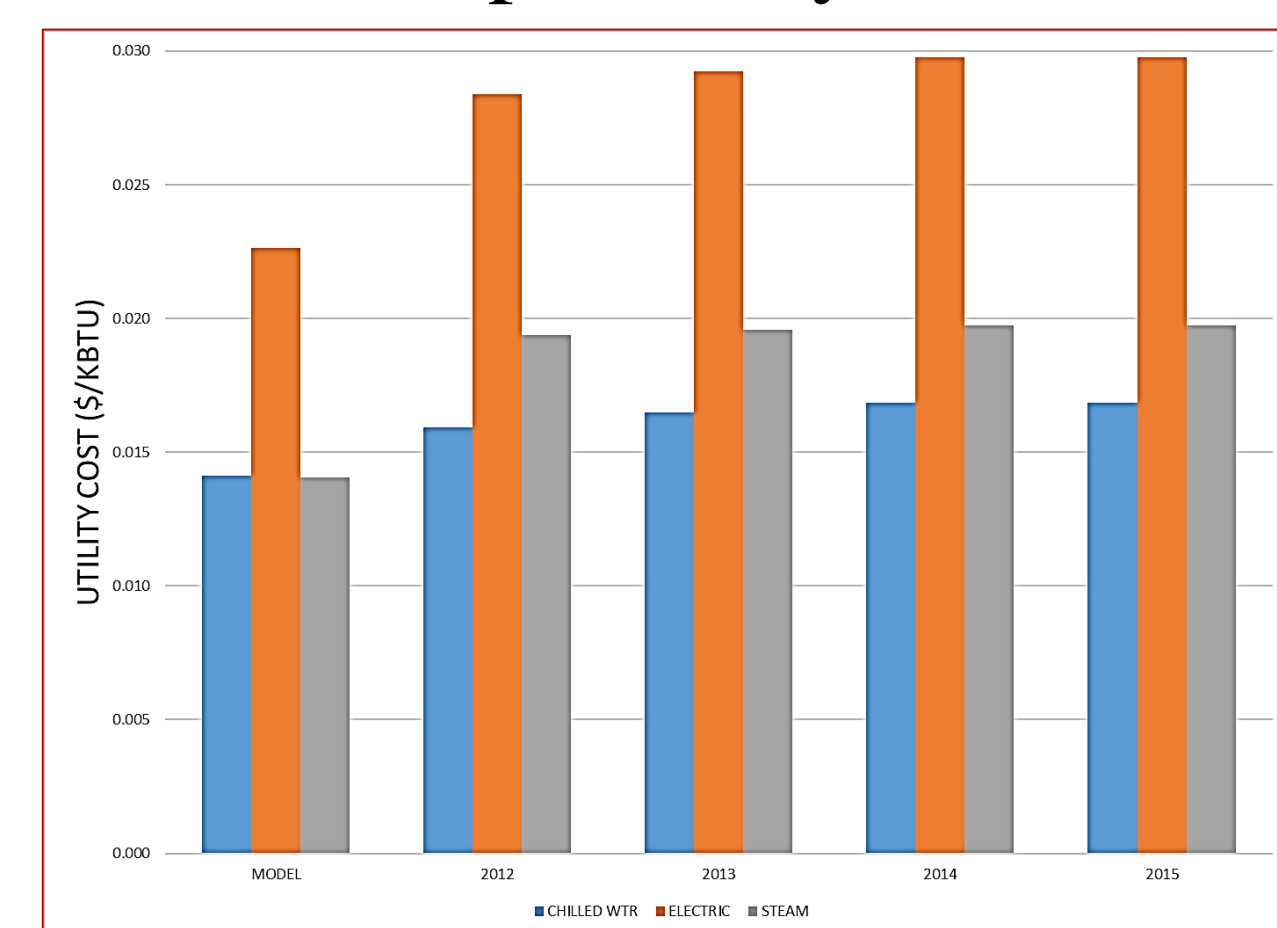


Fig. 7: Utility Rate Increase

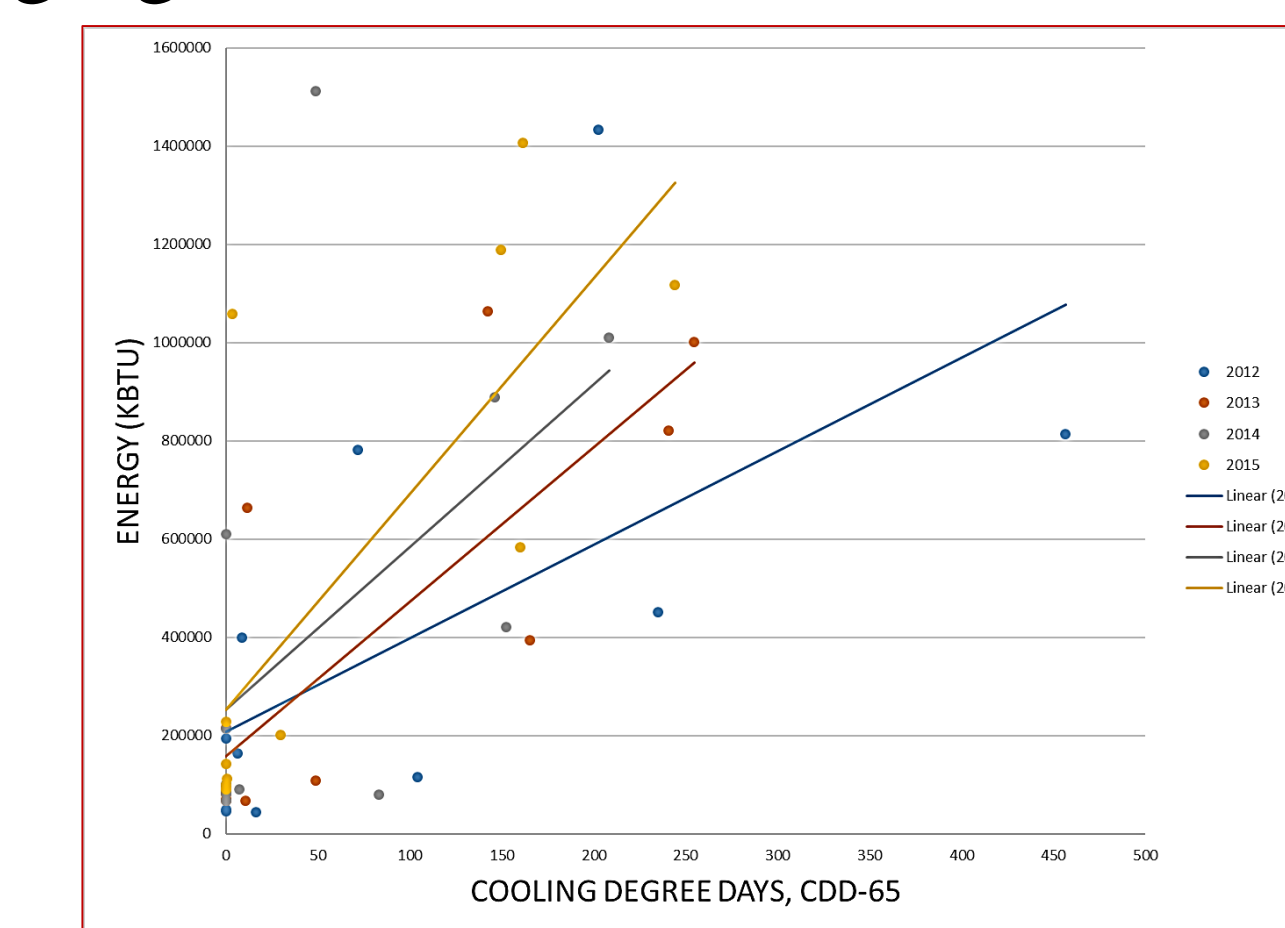


Fig. 8: Chilled Water Use Increase

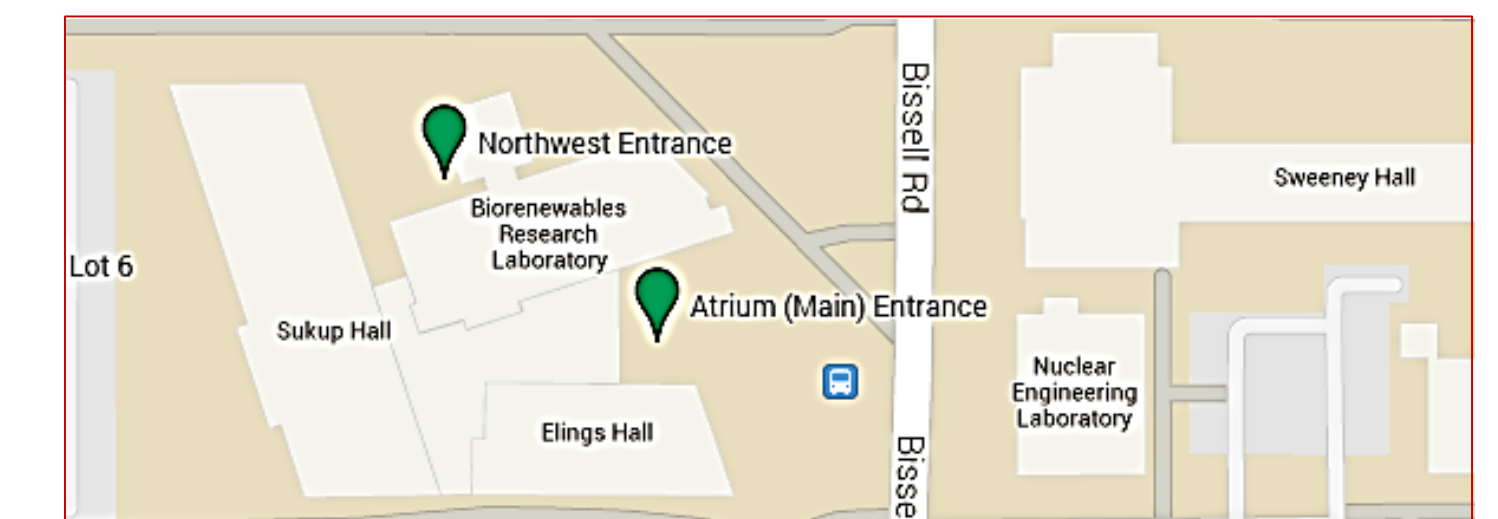


Fig. 2: BRL Location

Conclusions:

- Energy model assumptions may need to be updated with current utility rates to account for economic fluctuations.
- Further investigation into the model and operation of the building systems is needed to determine cause of consumption discrepancies within systems.

Future Direction:

- Improved building energy models for future buildings on campus will help ISU FP&M to foresee changes in utility bills for the campus so that they can adjust and plan accordingly.

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